REMARKS

Applicants have cancelled claim 74 without prejudice reserving the right to pursue the subject matter of the cancelled claim in a subsequently filed application.

Applicants have amended claims 59, 67, and 85 to recite applying "a nitrification inhibitor alone, without a nitrogen fertilizer, in a solution form, a crystalline form, or a fine particle suspension. . . ." Support for this amendment is found e.g. on page 9 line 23 to page 10 line 4 which recites:

> The application in solution form and/or fine particle suspension form helps the inhibitor to permeate throughout the soil surface layer enabling it to treat greater soil volume, slowing down its decomposition compared to situations where it remains on the soil surface following application in solid form ***with N fertilizer***. Multiple applications maintain the inhibition effect in the soil for longer time period compared to a single application. ***Most other studies have either combined DCD with an N fertilizer*** applied in a solid form or mixed with a liquid manure or effluent in a single application. (emphasis added)

See also page 21, line 14-18,

> The application of DCD applied in solution or fine particle suspension forms to the whole area of grazed pasture soils appears to be a very effective management tool to reduce NO_3^--N leaching in a grazed pasture system. ***The use of DCD alone*** could reduce NO_3^--N concentration in the drainage water .... (emphasis added)

Claims 59-100 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Cookson et al. (*Soil Biology and Biochemistry* (2002) 34:"1461-1465) in view of Sutton et al. (US Patent No. 4,994,100) and Smutek et al. (US Patent No. 4,560,796). In view of the following remarks and the attached

Declaration of Professors Di and Cameron, Applicants request that the Examiner reconsider and withdraw the rejection of the claims.

Applicants have discovered that applying DCD alone in a solution form, or a crystalline or fine particle suspension form to the whole of a grazed pasture soil unexpectedly increases pasture production regardless of whether or not a nitrogen fertilizer is present. The combination of Cookson et al., Sutton et al. and Smutek et al. fail to teach or suggest the method as claimed requiring a step wherein a nitrification inhibitor is applied ***alone*** to cover substantially the ***whole of an area*** of grazed pasture soil, including animal ***urine and non-urine*** patch areas in a sufficient amount and sufficiently covers the soil surface to reduce: nitrate leaching; nitrous oxide emissions; and to ***increase pasture production.*** Nor does the combination teach or suggest the unexpected result, increased pasture production, produced by Applicants' method.

The Examiner states that applying DCD in the Spring and/or Autumn, twice or multiple times a year is merely judicious selection and routine optimization absent evidence to the contrary. Applicants submit concurrently herewith a Declaration by Professors Hong Jie Di and Keith C. Cameron (the "Declaration"), and its attached exhibit Moir et al. 2007, "Effects of the nitrification inhibitor dicyandiamide on soil mineral N, pasture yield, nutrient uptake and pasture quality in a grazed pasture system *Soil Use and Management* (June 2007) 23:111-120, which demonstrates why the claimed method for increasing pasture production is not routine optimization and in addition produces surprising and unexpected results.

Prior to the filing date of this application those of skill in the art believed that nitrification inhibitors did not increase pasture production and because there was no increase in pasture production, there was no economic return from its use. The lack of increase in pasture production had been demonstrated more than thirty years ago by Turner and McGregor (1978) and recently reinforced by

the study by Cookson et al., which also showed no increase in pasture production in response to DCD application (see the Declaration paragraph 4).

Thus Applicants' discovery that treating substantially the whole of an area of grazed pasture soil, comprising animal urine and non-urine patch areas with the DCD alone without a nitrogen fertilizer, increases pasture production in both the urine and the inter-urine patch areas was a surprising and unexpected result. The unexpected increase in pasture production is evident in Applicants' peer-reviewed publication, Moir et al., describing the results obtained over four consecutive years using the claimed method "The application of DCD in grazed pasture had a significant effect of pasture growth on both the inter-urine and urine patch areas during all 4 years of the trial. In year 1, annual pasture yield was significantly higher for both inter-urine areas ($p < 0.05$) and urine patches ($P < 0.01$) which had received the DCD treatment...." (see Moir et al. page 114, right column, section entitled "Pasture Yield"). Applicants' results are surprising in view of Cookson et al. who concludes that Cookson's method for applying DCD (DIDIN) did NOT affect pasture yields,

> "DIDIN [DCD] treatments (either unamended or amended with urine) did not affect pasture yields, pasture N concentration and pasture N content compared with urine-amended or unamended plots alone."
>
> (page 1464, left col. first full sentence)

Applicants note that Cookson et al. does not teach applying a nitrification inhibitor to cover substantially the whole of an area of grazed pasture soil, including the animal urine and non-urine patch areas, but rather only teaches that decreasing the production of nitrate-N ($NO3^-$ -N) in cattle urine patches may reduce the environmental impacts of pastoral agriculture.

In paragraph 6, Profs. Di and Cameron (the "Declarants") state that the increased pasture production in the inter-urine patch areas was not only an

unexpected surprise but is also economically important. About 75% of the grazed pasture on a typical New Zealand farm is inter-urine patch area, urine patches account for the remaining 25% of a grazed field on typical dairy farms in New Zealand. Therefore, it is the extra pasture growth in the *inter-urine patch* areas that give the largest agronomic return for the farmer who uses the nitrification inhibitor methods as described in this application.

In paragraph 7, the Declarants describe another unexpected result, i.e., the increased pasture growth in both the urine and inter-urine patch areas is achieved with only one application in the Autumn and one application in the Spring of the nitrification inhibitor. Before the claimed invention, it was generally believed that the DCD effect in the soil is short-lived and repeated applications are required to sustain the inhibition effect. Applicants demonstrate that this is not the case and that just two applications can produce a significant effect on pasture growth.

The Declarants discuss a third unexpected result of the claimed invention (see paragraph 8). The pasture responses and the benefits of decreased nitrate leaching and nitrous oxide emissions can be achieved by treating the grazed pasture soil with the nitrification inhibitor alone in a form, amount and timing as specified in the claims, rather than being applied together with the nitrogen source, as the nitrification inhibitor was conventionally used, and as evidenced by Sutton.

As discussed in the Declaration of Professor Hong Jie Di and Professor Keith C. Cameron (attached)(see paragraphs 10-13), the method described in Sutton et al. is also very different from Applicants' claimed method in at least three major aspects.

One is that Sutton et al. describes the conventional way of using nitrification inhibitors, that is by combining the nitrification inhibitor (e.g. DCD) with the nitrogen source (e.g. urea) to increase the nitrogen efficiency from the

fertilizer that is treated. This is very different from Applicants' method which includes the step of applying the nitrification inhibitor DCD alone without any nitrogen source. The purpose of the DCD application is to treat the soil nitrogen, including that from the animal urine. Because Applicant's invention is designed to reduce nitrate leaching and nitrous oxide emissions, the DCD is applied alone during the wet cold season of the year, e.g. from late autumn through winter to early spring when nitrate leaching losses are high and plant growth rate is low. One of skill in the art would not apply the nitrogen fertilizer product as described by Sutton et al. in large quantities during the wet cold season of the year, e.g. from late autumn through winter to early spring when nitrate leaching losses are high because the fertilizer is not taken up by the plant due to low temperatures and slow plant growth. However, Applicants' claimed method can be used at these times of the year to treat the grazed pasture soils and reduces leaching and gaseous losses from animal urine that is deposited on the pasture soil.

The second major difference between Applicants' claimed method and the teachings of Sutton et al. is that the fertilizer in Sutton is applied in granules of 0.84-4.76 millimeters, whereas in Applicants method as claimed, the DCD is applied in a solution form, a crystalline form or fine particle suspension. This difference is fundamentally important, as discussed in paragraph 11 of the Declaration.

As Profs. Di and Cameron discuss, the reason for applying DCD in solution and fine particle suspension is to treat the entire grassland soil surface uniformly so that every micro-site of the soil surface is treated. Soil ammonia oxidizing bacteria that are responsible for the conversion of ammonium to nitrate in the soil are everywhere in the surface soil. If DCD is applied in granular form, such as in a form as that in Sutton et al., the granules only cover a small fraction of the soil surface area, leaving large gaps of the soil un-treated between the granules. When animal urine is deposited on the soil, there will be ammonia

oxidation and the production of nitrate will take place in the areas between the fertilizer granules. Therefore, if Sutton et al.'s fertilizer granules are used to treat grazed grassland soils, they will not be very effective in reducing nitrate leaching or reducing nitrous oxide emissions from the animal urine patches due to the non-uniform treatment. This is in clear contrast to the very uniform coverage provided by the DCD applied in solution form, crystalline form or fine particle suspension form. Once the soil is treated using Applicants' claimed method, the soil is uniformly treated, so the nitrification process is inhibited no matter where the urine may be deposited in the grazed grassland.

The third major difference between the invention as claimed and the method of Sutton et al. (discussed in paragraph 12 of the Declaration) is that Sutton et al does not suggest or even recognise that urine patches are the main sources of nitrate leaching and nitrous oxide emissions, and therefore Sutton et al. does not suggest the importance of treating these urine patches to reduce nitrate leaching and nitrous oxide emissions. No animal urine returns are mentioned in the document. The recognition of urine patches as a main source for nitrate leaching and nitrous oxide emissions is important because it affects the timing of application of the nitrification inhibitor (DCD). In one embodiment of the claimed invention DCD is applied alone shortly after grazing, when the urine patches are still fresh, for DCD to be effective in late autumn and early spring. Sutton et al. does not make any comments on the importance of urine patches in nitrate leaching and nitrous oxide emissions, and makes no mention of timing the application in relation to urine deposition.

The foregoing differences discussed by Profs. Di and Cameron are fundamental in nature between claimed method and the Sutton et al. method. Sutton et al. discloses a formulation of a granular fertilizer product, which contains a nitrification inhibitor to increase the efficiency of the nitrification fertilizer. Applicants claimed method requires the step of applying a nitrification inhibitor (e.g., DCD) alone in a particular form (solution, crystalline or fine

particle suspension) to treat substantially the whole of a grazed pasture soil, including urine and inter-urine patch areas at specified rates, timing and frequency to give a quantified sets of benefits: reducing nitrate leaching, reducing nitrous oxide and increasing pasture production in grazed pasture. Applicants' claimed method is therefore very different from the Sutton et al. method and represents a non-obvious method of using nitrification inhibitors alone to reduce nitrate leaching, reduce nitrous oxide emissions and increase pasture yield in both urine and inter-urine patch areas.

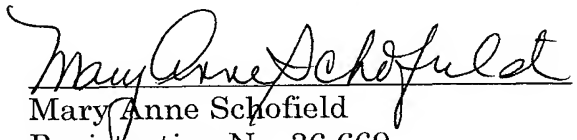
In Applicants' method, the application of the nitrification inhibitor alone, without a nitrogen fertilizer makes it possible to treat the urine patches that were deposited before or after the nitrification inhibitor is applied. It was unexpected, in view of the prior art, that such a treatment method would increase pasture production as well as reduce nitrate leaching and nitrous oxide emissions.

Applicants' method is not taught or suggested by the prior art and Applicants have demonstrated, see e.g. Moir et al. attached, that their methods produce unexpected results not previously taught or suggested by the cited art. Therefore the combination of Cookson et al., Sutton et al. and Smutek et al. fail to render the claimed invention obvious and Applicants request that the Examiner reconsider and withdraw the rejection of the claims under 35 U.S.C. 103(a).

If there are any questions regarding this response or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323, Docket No. 101547.55778US.

Respectfully submitted,



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